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Educational Potential of Virtual Worlds

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Introduction

In an era of increasing technological advances and dependence, new innovations and tools may prove to be effective in the field of education. One new technology is three-dimensional virtual worlds. Three-dimensional world environments are a space for users to interact with one another and objects in a shared space. Dickey (2003) defines three-dimensional virtual worlds “as networked, desktop virtual reality.” Most of the environments are web based; therefore allow for users in any location to access the space and interact with others. Three-dimensional virtual worlds differ from virtual reality in that the user of a three-dimensional virtual world utilizes the computer as a means to enter the virtual space. The user also has an avatar in the virtual space to manipulate in the various places. There is a degree of separation between the user and three-dimensional virtual worlds. Virtual reality immerses the user in a three-dimensional space through goggles or lenses. There is no avatar to seperate the user from the environment.

Three-dimensional virtual worlds show positive possibilities in the field of education. The shared space allows for a collaborative and cooperative environment. The environments allow users from any location with an Internet connection to access the space in real-time. This creates a possibility for a variety of users in various locations to meet together during a common time and connect with one another. Three-dimensional virtual worlds are immersive and engaging for students. They allow students to interact in a world that may not be physically possible in the real world. Virtual worlds also allow the user to test boundaries. While having an avatar can be both positive and negative, depending on one’s goal in the virtual environment, the avatar itself acts as a barrier to the real user and may give students a sense of empowerment and identity self-reflection.

Review of Literature

## Teaching in 3D: Pedagogical Affordances and Constraints of 3D Virtual Worlds for Synchronous Distance Learning

# Related Theories

“Three-dimensional (3D) virtual worlds are a new technology that holds some promise as constructivist learning environments for distance education” (Dickey, 2003). This article was an evaluative case study to examine Active Worlds and the effectiveness of its use for a synchronous distance education format.

# Research Questions

While the research did not have specific research questions, it was examining the effectiveness of Active Worlds in distance education. The research also examined constructivist learning environments and how virtual worlds may support a constructivist learning environment. “The purpose of this study is to examine how one 3D virtual world application, Active Worlds, supports a constructivist learning environment…by examining the pedagogical affordances and constraints of (a) the discourse tools; (b) the experiential tools; and (c) the resource tools. This first goal of this study is to illustrate the potential medium” (Dickey, 2003).

# Research Methods

“The investigation presents an evaluative case study of the pedagogical implications of using one 3D virtual world, Active Worlds, for synchronous distance education. The research design for this qualitative study focuses on the pedagogical affordances and constraints. Methods employed in the data collection include participatory observations, class logs, and formal and informal interviews with the instructor of a synchronous distance learning course offered through Active Worlds University” (Dickey, 2003).

# Participants

The participants were students in a “3D object-modeling course offered by AW University during the fall and winter of 1998-1999 taught by AW user Magine” (Dickey, 2003). “The instructor had building rights and eminent domain rights that allowed her to alter the setting to suit her needs…The class instructor, Magine, was the creator of Intro to RWX Modeling. Although she is an experienced programmer, she has no formal training in 3D modeling, nor has she any training as a teacher” (Dickey, 2003).

# Instruments

“Methods employed in data gathering include participatory observations and notes, class logs, screen-captured images, and formal interviews with the instructor in an attempt to provide a ‘thick description’ of the data” (Geertz, 1973).

# Procedure

“Data analysis consisted of a comprehensive review of class logs, notes, instructor interviews, and images gathered during the duration of the course. Categories were liberally derived based on Huberman and Miles’ (1994) variable-orientated and pattern-clarification strategies for identifying themes and patterns. Class logs were encoded two ways. The first coding consisted of teaching methods employed such as presenting concepts, amplification, and confirmation checks. The second encoding also relied heavily upon class logs; however, dialogue was encoded to look for patterns of various tool uses. After encoding revealed patterns of teaching methods and tool use, the course instructor, Magine, consented to additional follow-up interviews focusing on pedagogical issues pertaining to the various tools” (Dickey, 2003).

# Measurement

“Initial data were gathered during the fall of 1998 and winter of 1999. Subsequent observations were conducted during the winter and spring of 2000. Concluding interviews with the instructor were conducted during the winter and spring of 2001” (Dickey, 2003).

# Findings

“Findings reveal that although Active Worlds provides tools that support constructivist learning environments, the affordances and constraints of the tools (discourse, experiential, and resource) may, to varying degrees, impact the pragmatic use of this medium. While this initial investigation reveals that this technology supports constructivist learning environments, more research needs to be conducted to fully explore the potential of 3D virtual worlds as both distance and traditional classroom learning environments” (Dickey, 2003).

The discourse tools were positive in that the chat tool allowed for discussion, there were opportunities for synchronous distance learning, the instructor can provide immediate feedback and the text delays actually caused for thoughtful replies. The discourse tools were negative in that the text could only allow 255 characters; there was a need for the instructor to divide the instruction in parts because of the character limit and students held several conversations at one time.

The unique identities were positive in that they maintain anonymity, students could mute each other if needed, and the user had control over their learning environment. The negative aspects of the identities were that students posed as other students, there were limited avatar selection and students were similar avatars in a large class.

Kinesthetic constraints caused problems with moving avatars and providing gestures by the teacher.

## Information-Rich Virtual Environments: Theory, Tools, and Research Agenda

# Related Theories

“Many systems have been developed that use a three-dimensional (3D) space to present some form of information to the user. These include both immersive virtual reality systems and desktop 3D applications. Let us consider two categories of such systems: information and scientific visualizations” (Bowman et al., 2003). “Information visualizations present abstract information using a perceptual (usually visual) form. In contrast, IRVEs embed abstract information within a realistic 3D environment. In this way, abstract and perceptual information are integrated in a single environment” (Bowman et al., 2003). “IRVEs share a great deal in common with augmented reality” (AR)(e.g.[20]). Augmented Reality is a means of combining real-world images with computer generated text or visualizations. “While prior work in IRVEs has focused on the development and evaluation of proof-of-concept applications, we need a more precise theoretical framework if we are to approach IRVE research more systematically, and if we desire general results” (Bowman et al., 2003).

# Research Questions

“What is meant by “spatial,” “abstract,” and “symbolic” information? What makes a VE “realistic”?” (Bowman et al., 2003). “How can we reduce the cost of this room? What items are most costly? Are these columns aesthetic or essential for load bearing support?” (Bowman et al., 2003).

# Research Methods

“Although IRVEs can embed any type of abstract information, perhaps the boost basic function of IRVE’s is the inclusion of related text (or numeric) information into the VE. We have focused much of our initial work on this problem. We wish to perform research to answer questions about how to design effective and usable IRVEs. Besides the theoretical framework, we also need practical tools to carry out this research” (Bowman et al., 2003).The work involved a Software Development Framework, semantic objects, level of detail techniques and implementation data analysis.

# Participants

The research was a between-subjects design with 16 subjects (4 per condition- HOMER and Gaze Directed). There were 11 males and 5 females in the research. All subjects were computer science students (Bowman et al., 2003).

# Instruments

The instrument for data analysis was user interviews.

# Procedure

“Each user performed two tasks; with the order of the tasks counterbalanced…The tasks required the users to read the text on the display and to navigate around the environment to do so. We designed one task that required the user to navigate through all the trees. The second task required the user to travel long distances in the space and then read the information displayed on the objects” (Bowman et al., 2003).

# Measurement

“We measured the time per task and interviewed the subjects to obtain subjective usability and comfort data” (Bowman et al., 2003). “We used a two-factor ANOVA with replication for analysis of the time metric” (Bowman et al., 2003). “The experiment is moderately complex (four conditions, multiple tasks per condition, complex travel and text layout techniques)” (Bowman et al., 2003).

# Findings

“The analysis showed us that HOMER performed better than gaze-directed travel in both text conditions. However, there was no statistical significance in this finding (p> 0.05). This may have been caused by the low sample size in our experiment. Also, there was no statistically significant difference between the medium and large text quantity conditions” (Bowman et al., 2003).

## Exploring the educational potential of virtual worlds- Some reflections from the SPP

# Related Theories

“This [study] provides an overview of the first three phases of the SPP and briefly outlines the research methodologies used within it” (Twining, 2009). The Schome Park Programme (SPP) “aims at extending our thinking about schome, which aims to be the optimal educational system for the 21st century. Open virtual worlds like Second Life virtual world offer opportunities for people to have radically different ‘lived experiences’ of educational systems and thus seemed to be the ideal vehicle for exploring alternative models of education” (Twining, 2009).

# Research Questions

“To explore the educational potential of virtual worlds (with a particular focus on developing Second Life skills and ‘Knowledge Age Skills’, To build a community of learners, To enhance ‘knowledge Age Skills’, to increase student control and responsibility for the environment, the curriculum, the curriculum and support, to widen the community, to enhance ‘Knowledge Age Skills’, to balance control and responsibility for the environment, the curriculum and support, to widen the community and increase its size, to explore the co-existence of the schome ethos with school culture” (Twining, 2009).

# Research Methods

The island is divided into six areas: physics, ethics and philosophy, archaeology, Scho-op (generic support), shared meetings areas, and sandbox. The island, wiki and forum were made available 24/7/365. The island in visual representations changed from one that simulated real-life environments to an immersive game theme for new island (Twining, 2009).

# Participants

There were 250 students aged 13 to 17 from the National Association of Gifted and Talented Youth. Staff included staff from four universities, Staff from the National Physical Laboratory, PhD students, consultants, teachers, and parents (Twining, 2009).

# Instruments

“Chat logs of all conversations that staff were privy to in Schome Park…In-world photographs of activities taking place and the artifacts created; Machinima of activities; Participant observation; Entries by students and staff in the schommunity forum, wiki and blogs…; Informal interviews both in-world and via the forum and Flashmeeting; Sensor data showing the location of all avatars present on Schome Park once every 5 minutes; Recordings of all staff meetings; Usage data for the schommunity wiki and forum” (Twining, 2009).

# Procedure

“We started building Schome Park in ways that replicated our physical world experiences of educational spaces” (Twining 2009). “Our original design reflected our lack of understanding of the differences between virtual and physical spaces” (Twining, 2009). “From the outset, students behaved in ways which contrasted radically with the experiences that staff had had in their previous, physical world interactions with young people” The induction setting was more constructivist, in that the students did not want to “stand around” and wait to be escorted to various locations on the island. The students explored themselves and completed the orientation in an independent manner.

# Measurement

The study used Conole et al’s design of learning: “map directly onto three of the dimensions of practice which had emerged independently” within the project (Conole et al., 2004). The pedagogy dimension evaluates according to degree the immersive experience of the learner. The four examples are learning about, learn by doing, learn by playing a role, and learn by becoming. The students encountered each of these roles in the virtual environment. The theoretical dimension evaluates learning from individual constructivist to socio-cultural experiences (Twining, 2009).

# Findings

Avatars are reflective tools. “Part of the problem for educators in thinking about how to design educational activities in virtual worlds relates to our lack of familiarity with designing immersive environments” (Twining, 2009). The more difficult problem is moving educators from an “individual constructivist to a socio-cultural” approach with new goals and roles that transform education. (Twining, 2009).

Analysis

In analyzing these three research references, one can make the claim that the research only scratches the surface of virtual worlds. The research brings about more questions than answers and leads to a variety of authors in order to gain depth in the content. All three of the research articles discuss the possible benefits of virtual worlds, but there seems to be little research completed to this point to prove the benefits. One article brought an interesting point in stating that virtual worlds are not yet “norm” educational technology and therefore, teachers are not comfortable in using the technology to its fullest potential. The Dickey (2003) article was a good source for an overview of virtual worlds and their constraints on distance learning. The Bowman et. al. article (2003) discussed Information-rich virtual environments. What is most interesting about this article is the information delivery research. Many other articles focused in general the use of virtual worlds, but this article discussed what needs students may have when manipulating a virtual world. The Twining (2009) article used a real-world experience to analyze the possible benefits of virtual worlds. This article used advanced students only in the research and other research has indicated that students with learning disabilities are engaged with the technology. It will be interesting to research the impact of virtual worlds in all different groups of student learners, both advanced and below basic. These three articles indicate the need for continual research in the field of virtual worlds.

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